MODEL

221

INSTRUCTIONS
for
Wheelco Instruments

Wheelco Instruments Company

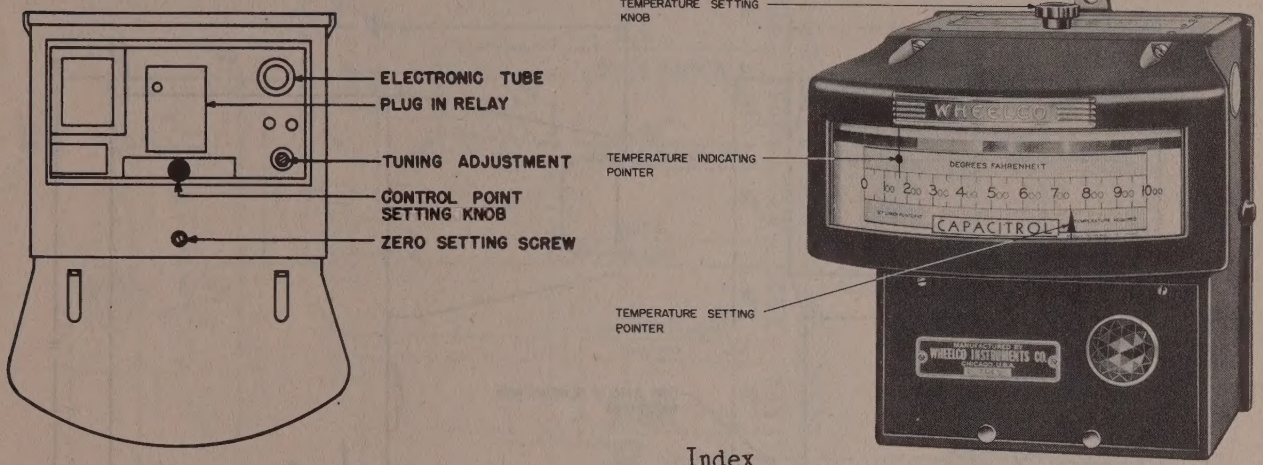
HARRISON AND PEORIA STREETS • • • CHICAGO 7, ILLINOIS

MP MASTER

MA32110

WHEELCO CAPACITROL

MODEL 221



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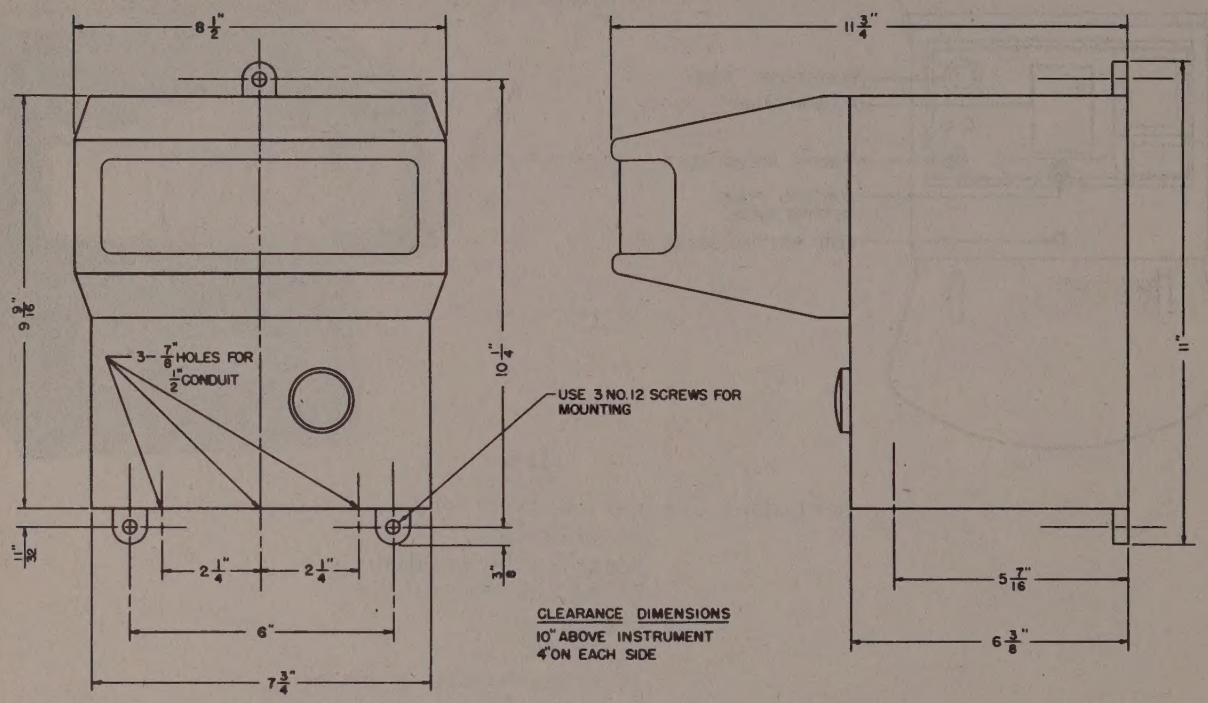
General Instructions

The model 221 Wheelco Capacitrol is a precision high resistance indicating and controlling pyrometer. Electronic control provides accurate and instantaneous control action without direct contact with the measuring system for indicating and controlling temperature. This model is of the two position, or "ON-OFF" type, as described in the Wheelco Educational Bulletin No. 5, "Automatic Temperature Control Systems".

(over)

MOUNTING DIMENSIONS



VIBRATION MOUNTS

In installations where vibration is a factor, we recommend the use of the Wheelco vibration mount kit No. RK2-2.

GUARANTEE

This equipment is guaranteed by us to be free from defects of material and of construction. Our liability shall be limited to replacing, or repairing without charge at our factory any material or construction defects which become apparent within one year from the date on which the equipment is shipped, except where quotations, or acknowledgements provide for a shorter period. We shall have no liability for direct or consequential damages of any kind, and the purchaser by the acceptance of the equipment assumes all liability for any damages which may result from its use, or misuse by the purchaser, his employees, or others.

FIELD SERVICE

Service engineers are available in most localities at a standard rate, by the hour, or day, plus expenses.

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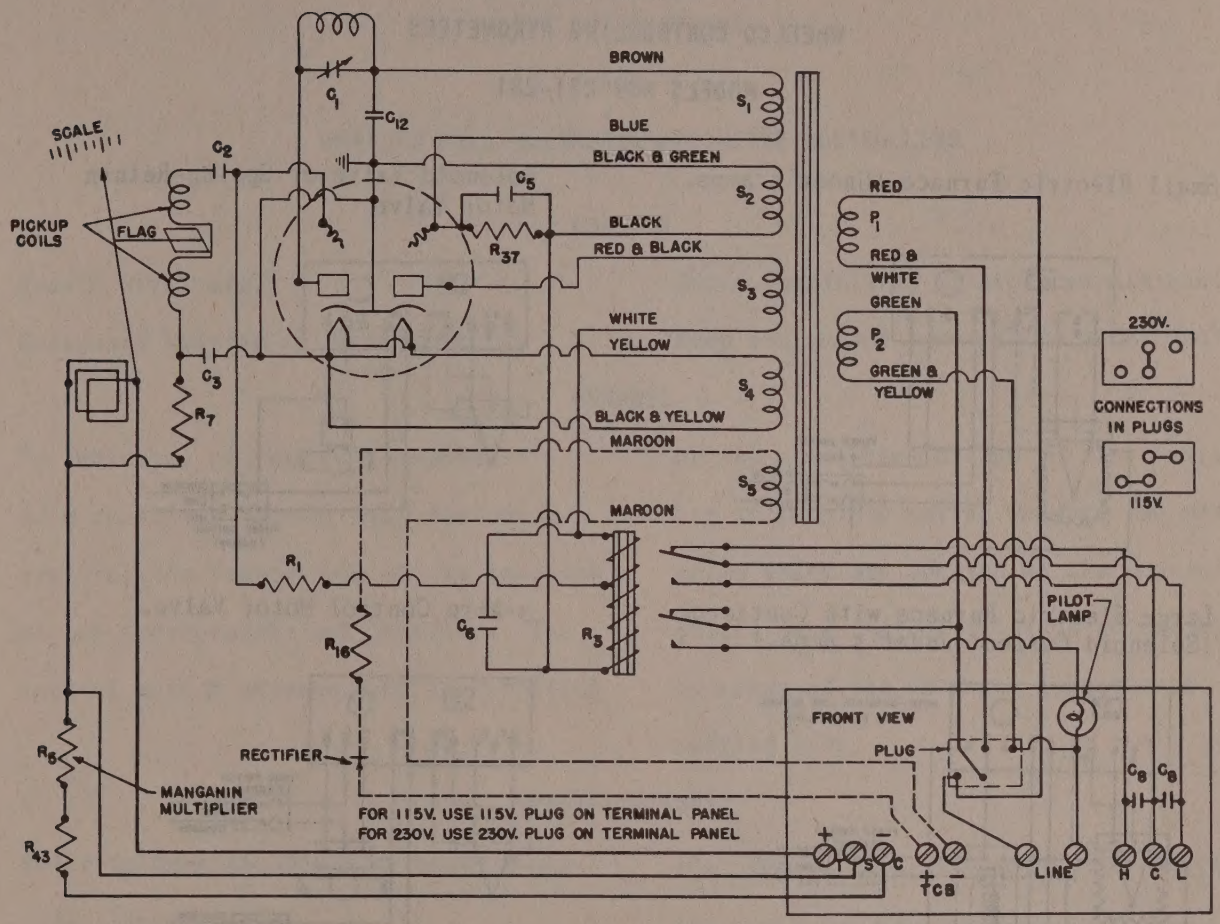
INTERNAL WIRING DIAGRAM
Model 221 and 221 TCB



The voltage rating of these instruments is determined by the voltage marked on the plug which is shown in dotted lines in the diagrams above.

Do not remove the plug while the instrument is powered. Always disconnect the line voltage first.

The circuit indicated with dotted lines is used in model 221 TCB only.

DIAGRAM NUMBERS	WHEELCO PARTS NUMBERS	DIAGRAM NUMBERS	WHEELCO PARTS NUMBERS	DIAGRAM NUMBERS	WHEELCO PARTS NUMBERS
C_1	RP2-11	R_1	RP2-8	S_1	30-037-2
C_2	RP2-21	R_3	RA2-7	S_2	Transformer
C_3	RP2-21	R_5	*	S_3	60 cycle
C_5	RP2-61	R_7	RP2-59	S_4	30-038-1
C6	RP2-56	R_{16}	**	S_5	Transformer
C8	RP2-61	R_{37}	RP2-88		25 cycle
C_{12}	RP2-83	R_{43}	RP2-33		

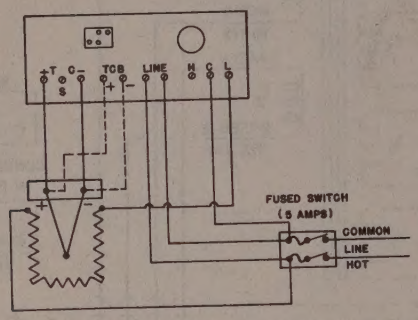
*Calibrating resistance spool according to range of meter.
**Resistance value dependent on range and thermocouple.

WIRING DIAGRAMS

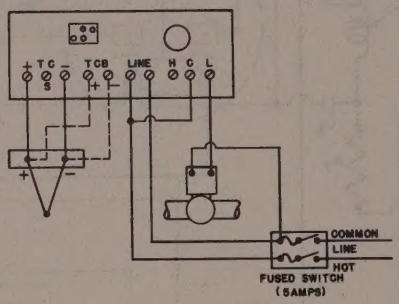
WHEELCO CONTROLLING PYROMETERS

MODELS NO. 221-231

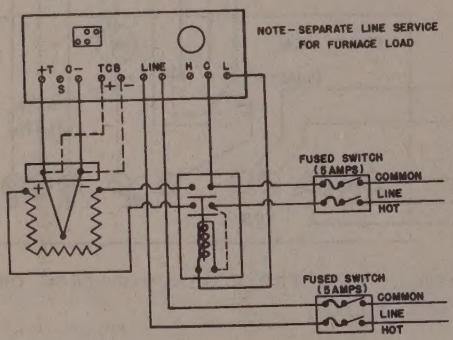
Small Electric Furnace (Under 5 amps.)



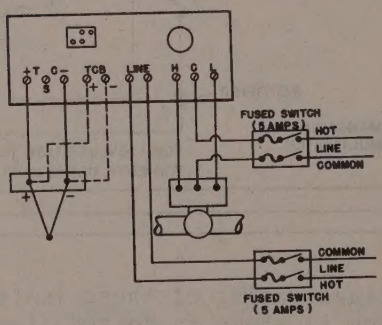
Solenoid Valve or Spring-Return Motor Valve



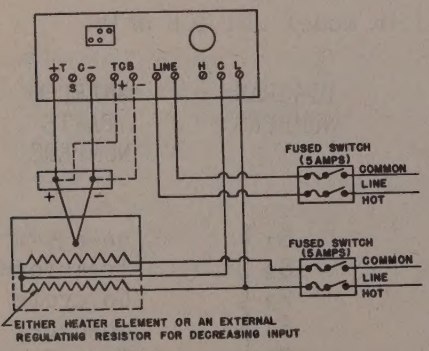
Large Electric Furnace with Contactor (Solenoid Current under 5 amps.)



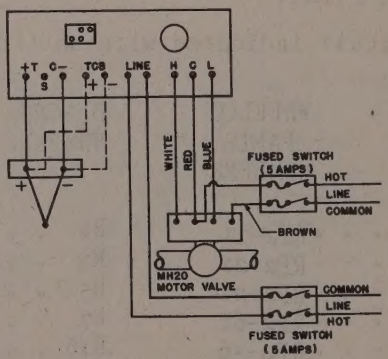
3-Wire Control Motor Valve.



High-Low Control of Electric Oven



4-Wire Control Motor Valve.



Note: T.C.B. on Terminal Panel is used only on instruments equipped with Wheelco Thermocouple-Break Protection. Instruments with this feature are so designated in Model Number listing as 221-T.C.B., or 231-T.C.B.

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SECTION II.

METER INSTRUCTIONS

FOR

WHEELCO MILLIVOLTMETER PYROMETER CONTROLLERS

CAUTION

Handle with care.

Safeguard instrument from shock.

Avoid possibility of oil accumulation!

Keep instrument temperature under 130°F.

PURPOSE

To indicate, or read the temperature of a connected thermocouple for controlling the temperature at the location of the thermocouple hot junction. The control action depends upon the position of the metal vane on the pointer behind the scale plate moving between two small coils which are located at the control point. The control point is adjustable by means of the external Temperature Setting Knob.

SPECIFICATIONS

Refer to Specifications on Scale Plate.

(A) Thermocouple:

The type of thermocouple to be used with meter is shown on the scale plate as follows:

C/A = Chromel vs. Alumel

I/C = Iron vs. Constantan

Pt. 13% = 13% Rhodium, 87% Platinum vs. Platinum.

(B) The external resistance for which the meter has been calibrated is shown at the bottom of the scale pan and is the combined resistance of the thermocouple plus the resistance of the Extension lead wire.

INSTALLATION

Please refer to installation instructions in Section III for additional information.

(A) Location: The instrument should be located to avoid vibration shock, dirt, moisture, oil drippings, and extreme temperatures.

Example: Avoid - furnace walls, machine frames, contactor panels, and outside walls.

(OVER)

INSTALLATION (Cont'd.)

(B) Mounting: Surface mounting models are designed for either wood or metal panels.

Universal mounting models are designed for bolting to a sheet metal panel through an opening of proper size, or may be adapted for surface mounting. Vibration mountings are available.

(C) Visibility: Glaring reflections on the scale window should be avoided.

(D) Wiring:

1. Disconnect the shunt wire or link between the thermocouple terminals AFTER the instrument is finally mounted on the panel. This connection between the terminals electrically dampens the meter movement for protection during installation or handling. The Control Index should also be turned to the high end of the scale. In case the instrument is to be removed, this shunt should be replaced and the control Index turned to the high end of the scale before dismantling. Refer to Figure 1.

2. Use only Extension Lead Wire supplied with this instrument, or Extension Lead Wire correct for use with the type of thermocouple specified on the Scale. Ordinary copper wire will NOT serve the purpose.

3. Proper polarity + and - of the Extension Lead Wire must be observed to obtain true readings. Upscale direction of the pointer movement is not sufficient evidence of correct polarity. Normally, the color coding is indicated on a tag attached to the Extension Lead Wire when shipped. The following procedure definitely checks the correctness of Extension Lead Wire Polarity:

Attach the Lead Wire without the thermocouple to the instrument and twist the free ends together. Heat the juntion thus formed. Deflection upscale means polarity is correct for the Lead Wire connections to the meter, If the indicating pointer moves down-scale, reverse the wires at the meter. The thermocouple should then be connected to the Extension Lead Wire and the pointer should move upscale when the thermocouple Hot Junction is heated. If the indicating pointer moves down scale, reverse only the connections at the thermocouple head, since the Extension Lead Wire has already been correctly connected to the meter terminals.

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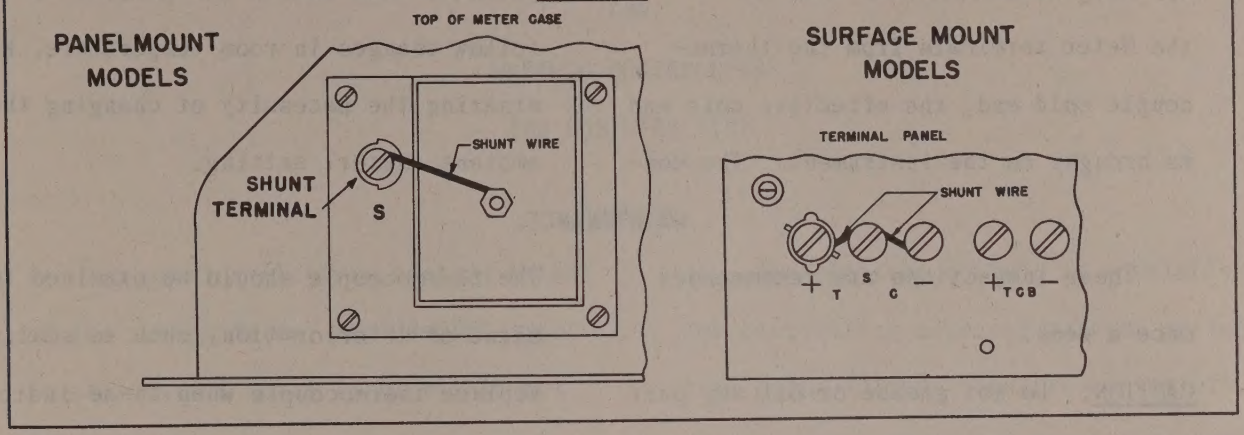
INSTALLATION (Cont'd.)

Figure 1



E. Thermocouple Location: The temperature that will be controlled is that of the thermocouple "Hot Junction". The location of the "Hot Junction" should be away from the load far enough to be partially affected by the source of heat to reduce overshooting. Most applications require a thermocouple protecting tube, because bare thermocouples, used in atmospheres or media causing chemical reaction may deteriorate the couple and destroy the calibration.

ADJUSTMENTS AND CHECKING BEFORE USING.

A. Check the meter indication on open circuit with one wire of duplex Extension Lead Wire disconnected. The pointer should come to rest and read the ambient (meter) temperature. It is NOT supposed to read at zero.

B. If the pointer does not come to rest at the ambient temperature, it should be adjusted by slowly turning the zero adjuster until the pointer rests at the instrument temperature, as checked by a thermometer with its bulb directly on the meter thermocouple terminals. Reconnect the lead wire after this checking is completed.

OPERATION

A. The Indicating Pointer of the pyrometer will move to indicate the temperature of the Hot Junction of its connected thermocouple. All power for the meter is generated by the thermocouple (no dry cells, etc.)

B. This instrument is equipped with an automatic cold junction compensator

(OVER)

OPERATION (Cont'd.)

By using Extension Lead Wire to the Meter terminals from the thermocouple cold end, the effective cold end is brought to the instrument. The compensator then causes the pointer to follow changes in room temperature, eliminating the necessity of changing the ambient (meter) setting.

MAINTENANCE.

These inspections are recommended once a week.

CAUTION: Do not grease or oil any part of the meter movement. Pivot and jewel construction is used for the meter movable coil.

A. Check the cold end, or ambient meter setting regularly. This is to be done as in paragraph "Adjustments and Checking Before Using."

B. Check thermocouple regularly! The thermocouple should be examined for signs of deterioration, such as scaling. Replace thermocouple when these indications become more than a trace. This is important since either or both the electrical resistance and the alloy of wire (if changed) will affect the accuracy of reading. The protecting tube should also be examined for leaks.

D. Inspect all wiring connections at the thermocouple head and the meter regularly.

CHANGING LOCATION

A. Replace the shunt wire, or link between the thermocouple terminals and "S" or "Calibrating Spool" terminal, as originally shipped to protect the meter during handling (Refer to Figure 1. Installation).

B. If possible, use the same length Extension Lead Wire of correct material when relocating the instrument.

C. Up to 25 ft. increase, or decrease in length of the Extension Lead Wire is allowable without recalibrating the meter.

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SECTION III

CONTROL INSTRUCTIONS

FOR

WHEELCO CONTROLLERS

TWO POSITION TYPE

PURPOSE

To provide electric control action of the two position, or "ON-OFF" type at any desired scale level within the range of the meter.

Two position control is adaptable for controlling solenoid valves, spring turn motor valves, electric contactors, or any device requiring a S.P.D.T. control switch action.

BEFORE INSTALLING

(A) Remove the meter of the Universal models from the case by removing the 4-corner screws holding the meter, and the plug-in connectors. This protects the meter during subsequent handling and installing of the controller case.

Surface mounting models should be handled gently since meter remains in the case during installation.

(B) Be sure the line voltage and frequency to be used are the same as shown on the Rating Plate.

(C) Auxiliary equipment such as valves, motor operators, contactors, etc. must also have their proper supply line voltage. If auxiliary equipment voltage rating is NOT the same as required for the controller, be sure the wiring diagram to be used provides for this feature.

(D) Protect the controller contacts by totalling the current (ratings) required by the controlled auxiliary equipment- This current requirement must be less than shown on the rating plate as maximum contact capacity.

INSTALLATION

(A) Location: The instrument should be located to avoid vibration, shock, dirt, moisture, oil drippings, and extreme temperatures. Avoid - Furnace walls, machine frames, contactor panels, and outside walls.

(OVER)

INSTALLATION (Cont'd)

(B) Mounting: The Universal controller case is designed for either surface or flush mounting. Fittings for surface mounting of Universal models are available. The surface mounting models may be mounted on any flat surface.

(C) Clearance: On Universal models, clearance on the panel is required if the knockout holes in back of the controller case are used. If the side, or bottom knockouts are used for conduit fittings, clearance for convenience is desirable, and depends on the location of auxiliary, or other equipment. On surface mounting models, allow 4 inches on each side and 10 inches above the top of the instrument.

(D) Visibility: Glaring reflections on the Scale Window should be avoided.

(E) Wiring: Refer to the External Wiring Diagram for this model.

1. Run all wires for power and controls in pipe, conduit, or Greenfield (BX) over entire length, in accordance with local code. Run Extension Lead Wire in Separate conduit.

2. Vibration mounting fittings are available and if they are used, use only Greenfield or BX adjacent to the instrument.

3. Ground the instrument case; standard installation using a grounded conduit system is usually sufficient.

4. Use properly fused switches as indicated on the wiring diagrams to protect the instrument.

5. Connect the meter with the thermocouple or resistance bulb using Extension Lead Wire, or 3 wire cable as required. Refer to Section II, paragraph "Installation." Important - Reversed Extension Lead Wire to the Thermocouple, or small gauge 3 wire cable over 1000 ft. to the Resistance bulb will result in incorrect readings.

6. If the instrument is equipped with the Thermocouple Break Protection feature (T.C.B.) connect the T.C.B. terminals to the connector block in the Thermocouple Head with copper wire. Instrument + terminal should be connected to + terminal in the Thermocouple Head, and - to -.

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ADJUSTMENTS AND CHECKING BEFORE USING.

(A) Refer to Section II, paragraph on "Adjustments and Checking Before Using" regarding the Meter and Thermocouple or Resistance Bulb

(B) Check the auxiliary equipment independently of the controller to guard against faulty wiring or damaging the controller contacts. This may be done by "by-passing" the instrument relay as follows:

1. Close the manual fuel valves on gas fired furnaces or open the heating switch on electric furnaces.

2. Before closing the controller line switch, disconnect common terminal #2, or C.

3. Power controller system.

4. Carefully touch the disconnected wire from #2 terminal to #1 or #3 for simulating the action of the Control Point Relay. #1, #2, #3 correspond to H.C.L.

(C) Check the controller operation while the power is connected and the above wires re-connected. This may be done by turning the Control Setting Index Knob slowly past the black pointer.

Control action operates the pilot light and control terminals #1, #2, and #3 (H.C.L.). Control "ON" position with the temperature below the Control Point connects #2 and #3 and turns the pilot light on. Control "OFF" position connects #2 with #1 and turns the pilot lights off.

(D) Tuning adjustment is needed if control action occurs when the black temperature indicating pointer is not exactly in line with the red Control Setting Index. To adjust, turn the tuning adjustment screw to the left slightly to raise the control "ON-OFF" point to operate when the red Control Index is coincided with the black Temperature Indicating Pointer. Turn to the right slightly to lower the point of action. Paragraphs B and C are useful for testing in case of control interruption.

E. To check a Controller which has the Thermocouple Break (TCB) circuit, move the control setting index to the top of the scale. Disconnect the thermocouple from the connector block. Leave the T.C.B. copper wires and the thermocouple

(OVER)

ADJUSTMENTS AND CHECKING BEFORE USING. (Cont'd.)

lead wires connected to the connector block. The black temperature indicating pointer should then move upscale past the red control setting index and operate the control to "OFF". If the pointer moves downscale, the TCB copper wires are either reversed or open. Reconnect the thermocouple for operation.

CONTROL OPERATION

(A) To set the Control Point:

Turn the Control Setting Knob to the desired temperature.

(B) Tuning Adjustment. If control action occurs too soon, or too late, as the black Temperature Pointer passes the red Control Index, the control circuit should be adjusted by tuning. For adjustment instructions, refer to "Adjustments and Checking Before Using," paragraph D.

(C) Electronic Tube Replacement. If the controller does not operate at the control point (Red Index) and the above Tuning Adjustment does not restore control action, the Electronic Tube should be replaced, using a carefully tested Capacitrol Electronic tube.

MAINTENANCE

CAUTION:

Do not oil or grease any part.

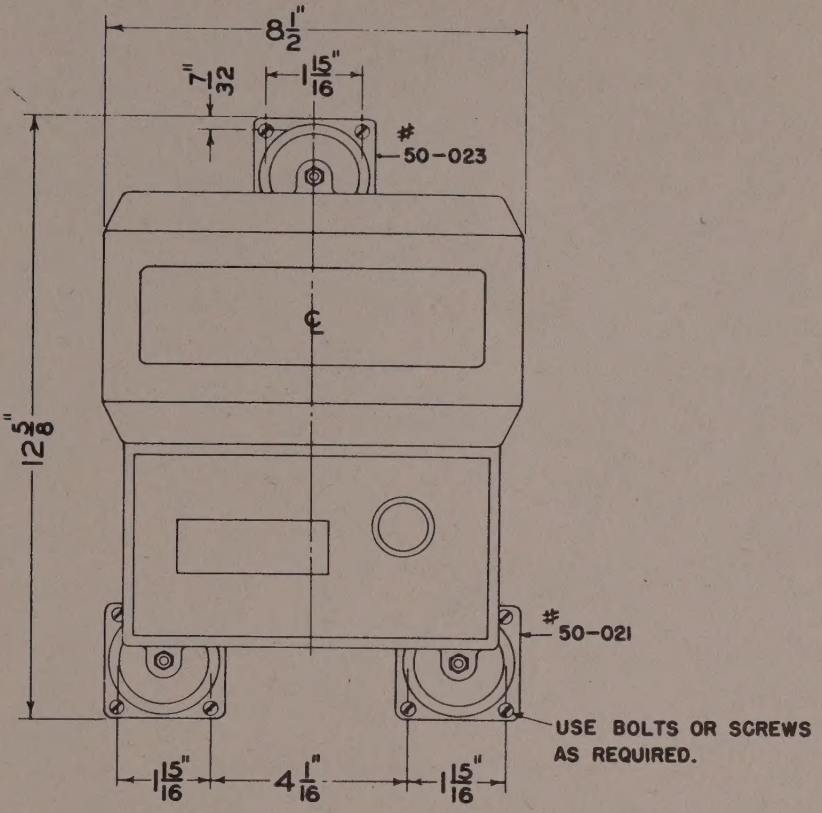
(A) For Meter Maintenance, refer to "Maintenance" in Section II of Meter Instructions.

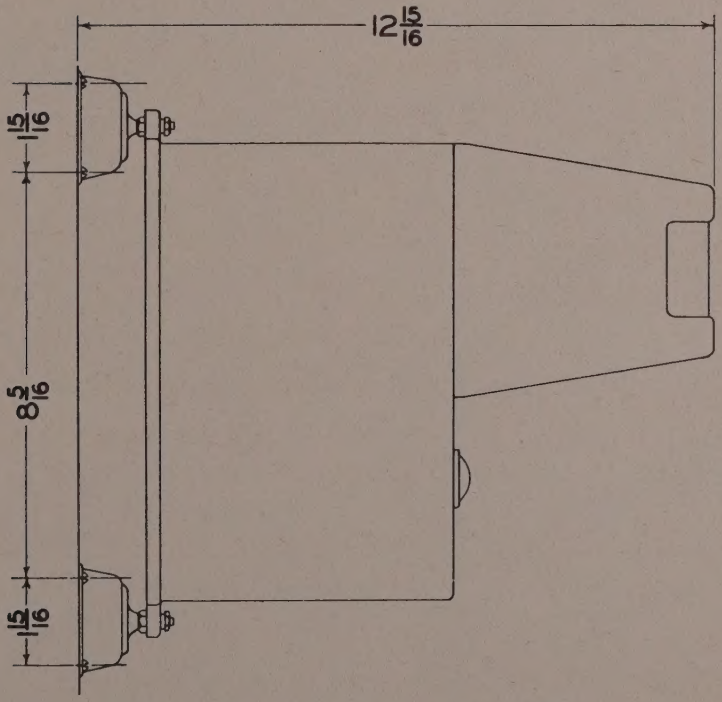
(B) Replace the Electronic Tube yearly since the cost is small compared to a possible service interruption.

(C) An inspection of the Electronic tube and relays should be made regularly. To make this checkup, use a test meter (0-30) D.C. Milliammeter) with a Wheelco Tube adapter (See parts list). The normal tube output is 18 M.A. or higher, when control is in the "ON" position, and 3 M.A. or lower in the "OFF" position. The relay is factory adjusted for 11 M.A. pull-in on current rise, and 9 M.A. let-go on decrease of current.

(D) Inspect all terminal connections, frequently, including line terminals, control terminals, and meter (thermocouple or resistance bulb) connections.

VIBRATION MOUNT KIT
FOR SURFACE MOUNTED INSTRUMENTS (PART NO. A0637)





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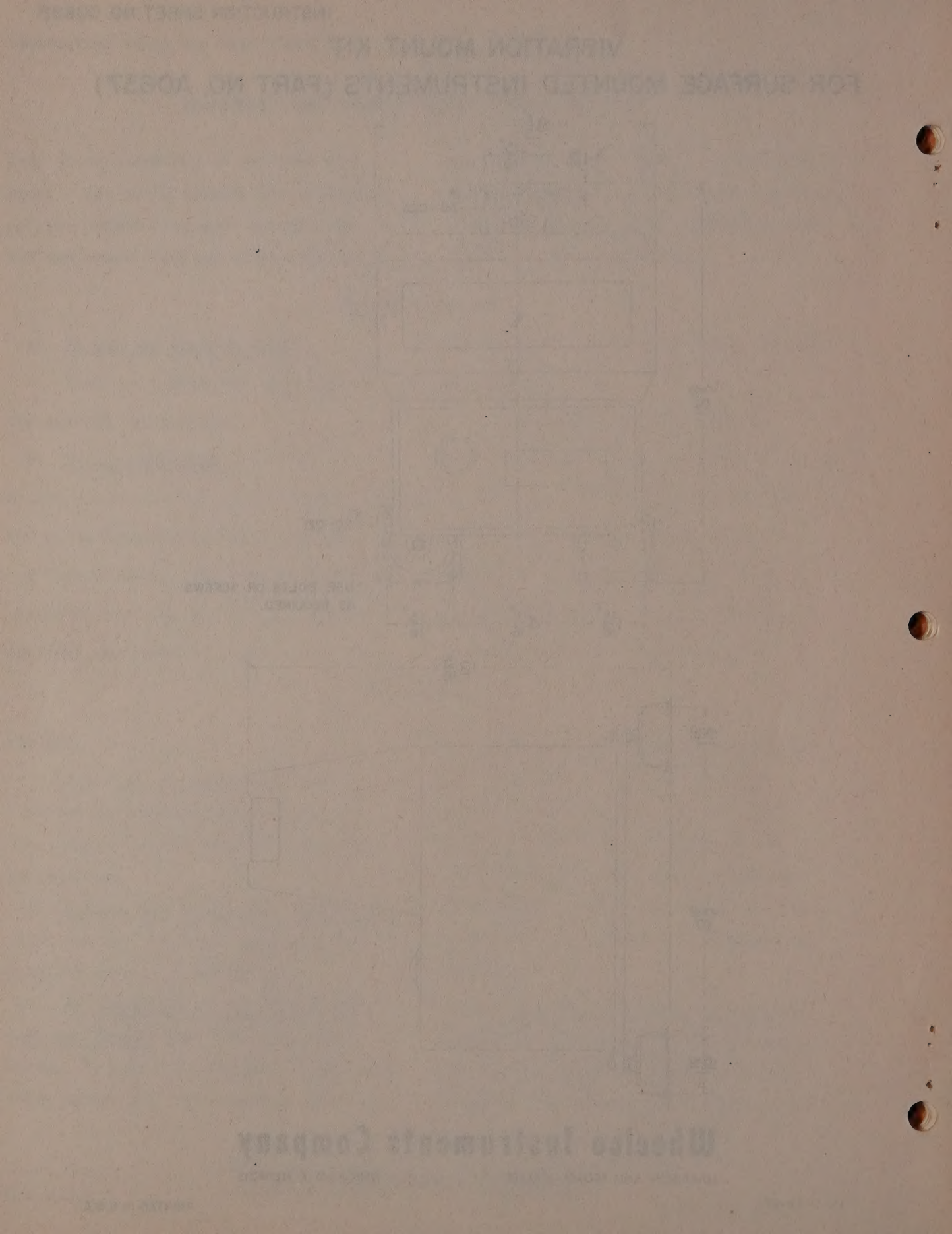

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